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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/701,476	11/06/2003	Keiji Fujita	04329.3172	8591

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Finnegan, Henderson, Farabow,
Garrett & Dunner, L.L.P.
1300 I Street, N.W.
Washington, DC 20005-3315

EXAMINER

PHAM, THANHHA S

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 01/11/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/701,476	FUJITA ET AL.	
	Examiner	Art Unit	
	Thanhha Pham	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 November 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 1-16 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 17-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>11/06/03</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This Office Action is in response to Applicant's Response to Restriction Requirement dated 10/02/04.

Election/Restrictions

1. Claims 1-16 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to nonelected inventions, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 11/02/04.
2. Applicant's election without traverse of claims 17-20 in the reply filed on 11/02/04 is acknowledged.

Oath/Declaration

3. Oath/Declaration filed on 03/17/04 has been considered.

Specification

4. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: A semiconductor device fabrication method using electron beam to enlarge pores in porous insulating film.

Claim Objections

5. Claims 17 and 19-20 are objected to because of informalities. Appropriate corrections are required.

▶ With respect to claim 17, line 8, term "and/or" should be changed to "or" to clarify the scope of the claim.

▶ With respect to claim 19, line 5, "a conductive material" should be changed to "said conductive material" to clarify the scope of the claim.

▶ With respect to claim 20, lines 2-3, "filling said recessed portion with a conductive material to form a plug and/or a wiring layer" should be changed to "filling said recessed portion with said conductive material to form said plug or said wiring layer" to clarify the scope of the claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 17 and 19 are rejected under 35 U.S.C. 102(e) as being anticipated by Kloster et al. [US 6,737,365].

**** Notice:** *Applicant cannot rely upon the foreign priority papers to overcome this rejection because a translation of said papers has not been made of record in accordance with 37 CFR 1.55. See MPEP § 201.15.*

► With respect to claim 17, Kloster et al. (figures 2-3's and cols. 3-6) discloses the claimed method for manufacturing a semiconductor device comprising:

forming a porous insulating film (304, dielectric layer comprising porogen PMMA, fig. 3A, col. 5 lines 42-62, col. 3 lines 50-67 and col. 4 lines 1-5) above a semiconductor substrate (301, col. 4 lines 54-65);

forming a recessed portion (306/305, fig. 3B, col. 5 lines 63-67) on a surface of said porous insulating film (304);

filling said recessed portion with a conductive material to form a plug or a wiring layer (307, fig. 3C, col. 6 lines 1-4);

wherein said porous insulating film (304, figs 3C-3D, col. 6 lines 4-13) is irradiated with electron beam to enlarge the size of pores of said porous insulating film.

► With respect to claim 19, Kloster et al. (figs 3C-3D, col. 6 lines 4-8) discloses enlarging the size of said pores through irradiation of electron beam onto said porous insulating film is performed subsequent to filling said recessed portion with the conductive material.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 18 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kloster et al. [US 6,737,365] in view of Lin et al. [US 2004/0175958].

► With respect to claim 18, Kloster et al. substantially discloses the claimed method including forming the porous insulating film above the semiconductor substrate wherein said porous insulating film is irradiated with the electron beam to enlarge the size of the pores of said porous insulating film. Kloster et al. does not specifically disclose that said pores of porous insulating film formed above said semiconductor substrate has an average diameter of 1 nm or less. However, Lin et al. (text paragraphs [0009] and [0033]-[0035]) discloses the size of the pores of the porous insulating film (33, fig. 3) formed above the semiconductor substrate (30) can have the average diameter as small as 1nm (text paragraph [0035] lines 4-15). Therefore, at the time of invention, it would have been obvious for those skilled in the art to modify process of Kloster et al. by using the porous insulating film with the pore size as being claimed, as taught by Lin et al, to provide the insulating film with low-k dielectric for preventing capacitance coupling and crosstalk problems in interconnection of the semiconductor device (see Lin et al., text paragraph [0002]).

► With respect to claim 20, Kloster et al. substantially discloses the claimed method including filling said recessed portion (305/306, fig. 3B) with the conductive material (307, fig. 3C) to form the plug or the wiring layer (307) (see col. 5 lines 63-67 and col. 6 lines 1-4). Kloster et al. does not specifically disclose said filling includes depositing a Cu layer through a barrier metal film. However, depositing the Cu layer

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through the barrier metal film to form the plug or the wiring layer is a known technique of forming interconnection in the semiconductor device. See Lin et al. (figs. 5-6 and text paragraph [0041]) as an evidence that teaches depositing the Cu layer (38) through the barrier metal film (37). Therefore, at the time of the invention, it would have been obvious for those skilled in the art to modify process of Kloster et al. by depositing the Cu layer through the barrier metal film as being claimed, per taught by Lin et al, to form the interconnection of the semiconductor device with good conductor and reliable performance -- since the Cu layer is a good conductor for forming the interconnection of the semiconductor device and the metal barrier film provides the known purpose of preventing copper diffusion to the insulating film.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanhha Pham whose telephone number is (571) 272-1696. The examiner can normally be reached on Monday and Thursday 9:00AM - 9:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, consisting of several loops and a horizontal line at the bottom.

Thanhha Pham
Patent Examiner
Patent Examining Group 2800